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REMARKS

Claim Rejections Under 35 U.S.C. § 112, Second Paragraph

Claims 2-44 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Examiner has asserted that

The instant claims are drawn to a catalytic process wherein a reactant is reacted with an organometallic compound to form a product in a microemulsion. However, the claims do not recite what type of catalytic process is being conducted, nor do the claims recite a name or structure of the possible reactants, or a name or structure of a product that is being made; as such the claims are found indefinite.

Applicants respectfully maintain that the claims as filed are not indefinite but in the interest of advancing prosecution, the claims have been amended to recite hydroformylation, carbonylation and hydrogenation as catalytic processes. Support for the amendments can be found in canceled Claim 23.

Applicants respectfully request the reconsideration and withdrawal of the rejection of claims 2-44 under 35 U.S.C. § 112, second paragraph.

Claim Rejections Under 35 U.S.C. § 112, First Paragraph

Claims 2-44 stand rejected under 35 U.S.C. § 112, first paragraph, for an alleged lack of enablement. Specifically, the Examiner alleges that

the specification, while enabling for a catalytic process, wherein an olefin is hydroformylated by the reaction of the olefin with hydrogen and carbon monoxide, and an organometallic catalyst, in a microemulsion further comprising water, a densified fluid, and a surfactant, to form a hydroformylation product, does not reasonably provide enablement for conducting *any* catalytic process that forms a product in a microemulsion, as suggested by the breadth of the instant claims. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. Accordingly, the examiner purports that it would constitute undue experimentation to determine what types of catalytic processes, as well as what types of reactants can be effectively employed

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in order to conduct a catalytic process as per the parameters of the instant claims.

Applicants have amended the claims to limit the claimed catalytic reactions to hydroformylation, hydrogenation and carbonylation. It is generally accepted that these three reaction types have distinct chemical similarities and as such teachings from one, particularly hydroformylation, could readily be applied to the other two.

Applicants respectfully assert that the amended claims do not require undue experimentation and are therefore not invalid for lack of enablement under 35 U.S.C. § 112, first paragraph. The test of enablement is not whether any experimentation is necessary, but whether, if experimentation is necessary, it is undue. *In re Angstadt*, 537 F.2d 498, 504, 190 U.S.P.Q. 214, 219 (C.C.P.A. 1976). There are many factors to be considered when determining whether there is sufficient evidence to support a determination that a disclosure satisfies the enablement requirement and whether any experimentation is undue. These factors include (A) the breadth of the claims; (B) the nature of the invention; (C) the state of the prior art; (D) the level of one of ordinary skill; (E) the level of predictability in the art; (F) the amount of direction provided by the inventor; (G) the existence of working examples; and (H) the quantity of experimentation needed to make or use the invention based on the content of the disclosure. *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988). In *Wands*, the Court held that the specification was enabling with respect to the claims at issue and found that "there was considerable direction and guidance" in the specification, there was "a high level of skill in the art at the time the application was filed," and "all of the methods needed to practice the invention were well known." *Id.* at 740. Another relevant case, highly pertinent both for its technical and legal issues is *In re Angstadt*, 537 F.2d 498 (C.C.P.A. 1976), where the court reversed the Board's finding that undue experimentation was required. In *Angstadt*, the claims at issue were directed to the use of organometallic complexes to convert secondary and tertiary alkylaromatic hydrocarbons to the corresponding hydroperoxides. *Id.* at 499. The court held that, even in an unpredictable art like chemical catalysis, applicants are "not required to disclose *every* species encompassed by their claims." *Id.* at 503 (emphasis in original). The court went on to hold that "[i]n this art the

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performance of trial runs using different catalysts is 'reasonable,' even if the end result is uncertain, and we see no reason on this record why appellants should not be able to claim as their invention the broad range of processes which they have discovered." *Id.* at 504.

With these precedents in mind, we analyze the *Wands* factors.

Nature of the Invention

Applicants' claims relate to three catalytic processes in a water-in-densified fluid microemulsions. Applicants' broadest claim, claim 27, specifies the use of a surfactant (to form the microemulsion), an organometallic catalyst to convert a reactant to a product, and a microemulsion pH of about 2 to about 8. Claim 27 also requires separating the product from the microemulsion. The pH limitation of claim 27 is very significant, as Applicants have discovered that reaction rates in water-in-densified fluid microemulsions may be significantly enhanced by adding base in order to produce a pH of about 2 to about 8. See paragraph 18 and Examples 1-5 of the instant application.

Breadth of Claims

Amended claim 27, discussed above, is limited to three types of reactions, significantly limits the catalyst type (organometallic catalyst) and the reaction medium (a water-in-densified fluid microemulsion having a pH of 2 to about 8). In the respects that the claims are broad, it is because Applicants' discovery of a method of performing organometallic-catalyzed reactions in water-in-densified fluid microemulsions at a specified pH value is applicable to all three reaction types. In other words, the scope of the claims is commensurate with Applicants' contribution to the field.

State of the Prior Art

Applicants agree with the Examiner that catalysis in water-in-carbon dioxide microemulsions is known. See U.S. Patent No. 5,814,678 to Randolph, of record. Applicants also assert that the field of organometallic catalysis in general is well developed. Hydroformylation itself was discovered in 1938 and has been commercialized and intensively studied for over 60 years. Similarly, carbonylation and

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hydrogenation have been known and studied extensively. Thus, the state of the art was well developed as of Applicants' filing date.

Also well developed was the field of solubility properties, which would allow one or ordinary skill in the art to select reactants, products, and catalysts suitable for use in water-in-densified fluid microemulsions. Although the fields of emulsion and microemulsion catalysis were less well developed than those of homogeneous catalysis and solubility properties as of Applicants' filing date, the states of those arts were also sufficiently developed to have allowed one skilled in the art to select operative embodiments and avoid inoperative embodiments. In sum, at the time Applicants' application was filed, one skilled in the art would have been able to select reactants, products and catalysts suitable for use in water-in-densified fluid microemulsions having a pH of 2 to 8.

Predictability of the Art

Chemical catalysis has been characterized as a relatively unpredictable art. See, e.g., *In re Angstadt*, 537 F.2d 498, 503 (C.C.P.A. 1976). However, the predictability of catalytic reactions has been dramatically improved in the twenty-eight years since *Angstadt* was decided. It is interesting to note that all the cases cited within MPEP 2164.03 for the proposition that the chemical arts are unpredictable are even older than *Angstadt*. Furthermore, even in the art of chemical catalysis at the time of *Angstadt*, it did not constitute undue experimentation for one skilled in the art to perform trial runs with different chemical species. *Id.* at 504. Here, it would not require undue experimentation for one of ordinary skill in the art to test different catalysts in order to perform a particular chemical conversion (i.e., to convert particular reactants to a particular product). This is especially true because of the guidance provided by Applicants in how to form effective microemulsions and the advanced state of knowledge regarding effective water-soluble catalysts for various chemical conversions.

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The application provides sufficient guidance on how to use the claimed invention. In particular, note paragraphs 9 and 10 (directed to suitable densified fluids), paragraphs 14-17 (directed to suitable surfactants and water contents for microemulsions), paragraph 18 (directed to microemulsion pH), paragraphs 20-28 (directed to suitable organometallic catalysts and their component ligands), and paragraphs 29 and 30 and 32 (directed to batch and continuous modes of carrying out the invention). In short, Applicants have provided substantial and sufficient guidance on how to use the claimed invention. That their method is applicable to a wide variety of catalyzed reactions does not detract from the sufficiency of their disclosure. Rather, it adds to the value of that disclosure. Any perceived deficiency in detailed teachings about catalytic processes is compensated by the high skill of those practicing the art and the advanced state of knowledge in the fields of organometallic chemistry, catalysis, emulsion science, and solubility properties.

Presence of Working Examples

The application includes working examples 1-5 (illustrating five sets of reaction conditions for hydroformylation of four olefins), and example 6 (illustrating the effect of pH on microemulsion cloud point pressure). The examples illustrate how to form the microemulsions and how to adjust their pH in order to produce increased reaction rates. Although the working examples are focused on one particular embodiment (hydroformylation), it must be borne in mind that working examples are not required to enable an invention. *See In re Wright*, 999 F.2d 1557, 1561 (Fed. Cir. 1993) ("Nothing more than objective enablement is required, and therefore it is irrelevant whether [a] teaching is provided through broad terminology or illustrative examples.") "The specification need not contain an example if the invention is otherwise disclosed in such a manner that one skilled in the art will be able to practice it without an undue amount of experimentation." MPEP 2164.02 (citing *In re Borkowski*, 422 F.2d 904, 908 (C.C.P.A. 1970)). Applicants respectfully submit that their pending claims are enabled even without their working examples. It is therefore improper to argue that the scope of enablement is commensurate only with the scope of the working examples.

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Relative Skill of Those in the Art

Applicants respectfully assert that the ordinary level of skill in the field of catalysis is extremely high. For example, a typical person conducting research in the area to which Applicants invention applies would have an advanced degree.

Quantity of Experimentation Necessary

While some experimentation may be necessary in order to practice Applicants' claimed invention, that amount of experimentation is not undue. This is true because of Applicants' detailed teachings on how to form the microemulsions used in their method, and because of the substantial bodies of knowledge in the fields of catalysis, organometallic chemistry, emulsion science, and solubility properties. Furthermore, "[t]he fact that experimentation may be complex does not necessarily make it undue, if the art typically engages in such experimentation." MPEP 2164.01 (citing *In re Certain Limited-Charge Cell Culture Microcarriers*, 221 U.S.P.Q 1165, 1174 (Int'l Trade Comm'n 1983), *aff'd sub nom.*, *Massachusetts Institute of Technology v. A.B. Fortia*, 774 F.2d 1104 (Fed. Cir. 1985); *In re Wands*, 858 F.2d at 737 (Fed. Cir. 1988). Applicants respectfully submit that any experimentation required to use their invention is no more complex than that typically encountered in the field of catalysis.

Summary of Wands Factors

Applicants respectfully submit that the *Wands* factors, taken together, show that undue experimentation is not required for one of ordinary skill in the art to practice Applicants' claimed invention. In particular, the high level of ordinary skill in the art, Applicants' detailed teachings about how to form and use their microemulsions, and the wealth of knowledge available to the skilled artisan in the fields of organometallic chemistry, catalysis, emulsion science, and the solubility properties make it possible for one of ordinary skill in the art to utilize the invention without undue experimentation. Accordingly, Applicants respectfully request the reconsideration and withdrawal of the rejection of claims 2-44 stand rejected under 35 U.S.C. § 112, first paragraph.

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It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance is requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

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